Statement of Basis

Air Quality Construction Permit

Otter Tail Power Company
Big Stone Power Plant

Big Stone City, South Dakota

South Dakota Department of Environment and Natural Resources

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1.0 BACKGROUND

Otter Tail Power Company operates the Big Stone power plant near Big Stone City, South Dakota. The Big Stone plant is co-owned by NorthWestern Corporation d/b/a NorthWestern Energy, Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc., and Otter Tail Power Company. The Big Stone power plant is a steam to electric energy conversion facility which uses subbituminous coal as the primary fossil fuel. The power plant also supplies steam to the adjacent POET Biorefining facility. The primary Standard Industrial Classification (SIC) code is 4911 – Electric Services.

On December 20, 2010, Otter Tail Power Company submitted an application for a construction permit for the installation of pollution controls and associated equipment at the Big Stone facility. The Air Quality Control System (AQCS) project is the outcome of a Best Available Retrofit Technology (BART) determination under the State of South Dakota's Regional Haze Program (ARSD 74:36:21) and the State Implementation Plan (SIP). Otter Tail Power Company submitted additional information on December 30, 2010, and January 21, 2011. On June 13, 2011, November 9, 2011, and November 28, 2011, Otter Tail Power Company submitted revisions to the materials handling emission points. The application was considered complete on November 28, 2011.

1.1 Existing Permitted Equipment

Table 1-1 provides a list of processes and equipment covered under the existing Title V air quality operating permit for the Big Stone power plant.

Table 1-1 – List of permitted processes and equipment

Unit	Description	Operating Rate	Control Device
#1	1975 Babcock & Wilcox Company balanced draft, cyclone-fired steam boiler that is used to produce electricity and provide steam to an ethanol plant. The boiler is equipped with an over-fire air system and fired on subbituminous coal and alternative fuels and wastes.	5,609 million Btus per hour	Baghouse The exhaust gases from the baghouse shall be routed to the wet flue gas desulfurization system associated with Unit #13.
#2	1973 Combustion Engineering auxiliary steam boiler, Model #31-A014. The boiler is fired with distillate oil and biodiesel.	210 million Btus per hour heat input	Not applicable
#3	1961 Bros steam heating boiler, Model #461-03. The boiler is fired with distillate oil and biodiesel.	98 million Btus per hour heat input	Not applicable

Unit	Description	Operating Rate	Control Device
#4	1974 Waukesha Power Systems emergency diesel generator, Model #VHP5900 DSIU. The diesel generator is fired with distillate oil and biodiesel.	1,000 kilowatts heat output	Not applicable
#5 [1]	Live fuel storage building and transfer point.	3,000 tons per hour	Baghouse
#6 [1]	Rotary car dumper conveyor.	3,000 tons per hour	Baghouse
#7a	Rotary car dumper building.	3,000 tons per hour. The maximum capacity may increase to 3,600 tons per hour during the term of this permit.	Baghouse
#7b			Baghouse
#7c			Baghouse
#7d			Baghouse
#8	Fuel transfer house.	1,100 tons per hour	Baghouse
#9	North fuel conveying system and silo vents.	550 tons per hour	A set of baghouses
#10	South fuel conveying system, silo vents, and plant distribution bin.	550 tons per hour	A set of baghouses
#11	Fly ash storage silo.	19 tons per hour	Baghouse. A second baghouse is installed as a back-up.
#12	Lime storage silo.	15 tons per hour	Baghouse

The existing Title V air quality operating permit includes Units #13, #14, #15, #25, and #33 that were part of the proposed Big Stone II coal-fired electric generating unit. Otter Tail Power Company and its partners have since elected not to move forward with construction of the Big Stone II project.

1.2 Proposed Air Quality Control System Project

The existing Big Stone plant boiler (Unit #1) will be retrofitted with a selective catalytic reduction (SCR) system and separated over-fire-air (SOFA) for nitrogen oxide (NO_x) control and a semi-dry or dry flue gas desulfurization (FGD) system for sulfur dioxide (SO_2) control. The existing fabric filter for particulate matter (PM) control will be replaced with a new fabric filter. In addition, the boiler outlet flue gas temperature will be reduced to within the operating range required for the SCR catalyst by redesigning portions of the boiler heat exchange surface. The boiler efficiency is expected to improve as a result. However, there will be no significant emissions increase associated with Unit #1.

Changes to the boiler may include, but are not limited to, one or more of the following, contingent upon the final project design and review by the Big Stone plant co-owners:

1. New reheat outlet and inlet bank including an additional reheat pendant inlet bank for

increased surface area;
2. New primary superheater including an additional horizontal primary superheater bank for increased total surface area;
3. Three new V-Temp™ economizer banks or alternatively installation of additional economizer surface;
4. Remove the flue gas recirculation economizers;
5. Lower and redesign the flue gas recirculation intake structures and install new support trusses; and
6. Re-enforce the boiler and associated duct work to accommodate the increased flue gas draft.

Otter Tail Power Company is also proposing the project to provide for installation of activated carbon injection on Unit #1 for mercury control in anticipation of EPA's utility MACT rule. The project will include installation of a lime storage silo, carbon storage silo, and addition of a larger waste FGD silo. The lime storage silo and waste FGD silo are common to either the semi-dry or the dry flue gas desulfurization system. A hydrator buffer bin, lime hydrator, and an additional storage silo for hydrated lime will be required if the dry FGD system is selected. A recycle storage silo will be required if the semi-dry FGD system is selected.

The following processes and equipment will be reviewed for coverage under the air quality construction permit. In accordance with department policy, the proposed units will be numbered sequentially based on the highest number used in previous permitting actions.

Unit #1 1975 Babcock & Wilcox Company balanced draft, cyclone-fired steam boiler that is used to produce electricity and provide steam to an ethanol plant. The boiler is equipped with an over-fire air system and fired on subbituminous coal and alternative fuels and wastes. The boiler will be retrofitted with a selective catalytic reduction system and separated over-fire-air for nitrogen oxide control and a semi-dry or dry flue gas desulfurization system for sulfur dioxide control. The existing fabric filter for particulate matter control will be replaced with a new fabric filter.

Unit #34 Lime storage silo. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined.

Unit #35 Carbon storage silo. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined.

Unit #36a Waste FGD storage silo – Vent #1. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined.

Unit #36b Waste FGD storage silo – Vent #2. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined.

Unit #37a Recycle storage silo – Vent #1. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined. This unit will only be installed if the semi-dry FGD system is selected.

Unit #37b Recycle storage silo – Vent #2. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined. This unit will only be installed if the semi-dry FGD system is selected.

Unit #38a Hydrated lime storage silo – Vent #1. Particulate emissions will be controlled using

a pulse jet baghouse, manufacturer and model to be determined. This unit will only be installed if the dry FGD system is selected.

Unit #38b Hydrated lime storage silo – Vent #2. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined. This unit will only be installed if the dry FGD system is selected.

Unit #39 Hydrator. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined. This unit will only be installed if the dry FGD system is selected.

Unit #40 Hydrator buffer bin. Particulate emissions will be controlled using a pulse jet baghouse, manufacturer and model to be determined. This unit will only be installed if the dry FGD system is selected.

1.3 Insignificant Activities

In accordance with Administrative Rules of South Dakota (ARSD) 74:36:05:04.01, Otter Tail Power Company identified articulated trucks used in landfill load-in/out and a dozer used for landfill pile maintenance as insignificant activities exempt from permitting. These activities fall under ARSD 74:36:05:04.01(2) which provide an exemption for a mobile internal combustion engine, including engines in autos, trucks, tractors, airplanes, locomotives, and boats.

2.0 PROJECT DESCRIPTION

In the application, Otter Tail Power Company stated the boiler efficiency is expected to improve as a result of the boiler work; however, the hourly boiler heat input will not increase above the current permitted level of 5,609 million (MM) Btus per hour. The plant will need to provide additional electricity to the AQCS project, i.e., increased station service, as reflected by the increase in the net plant heat rate (Btu/KWh net). The additional energy requirement will require the combustion of additional coal. Otter Tail Power Company stated the projected increase in boiler emissions is very conservative because it is based on the assumption that the additional coal can be burned over the entire plant load range as compared to the baseline period. However, once the AQCS project is complete, the available net electrical output to the Midwest Independent System Operator (MISO) grid will decrease as compared to historical output during those periods when the output to the MISO grid would have been greater than the difference between the maximum gross electrical capacity of the unit and the station service including an additional 9 megawatts attributable to the AQCS project.

Otter Tail Power Company used the following illustration to demonstrate that the projected increase in boiler emissions is very conservative. Assuming the unit was operating at full capacity during the baseline period – i.e., at the maximum heat input rate of 5,609 MMBtus per hour – at a net heat rate of 10,565 Btus per kWh, the maximum net out put to the MISO would have been approximately 531 MW. If the AQCS project results in a net heat rate of 10,715 Btu per kWh (as assumed in the illustration), the net maximum output of the unit to the MISO grid will be approximately 523 MW (about 9 MW less than before-the estimated station service for the AQCS equipment), because the maximum hourly heat input rate of the boiler remains the

same (5,609 MMBtus per hour). In other words, at full capacity, the unit would not burn any additional fuel but would produce about 9 MW less of net power to the MISO grid. Therefore, the assumption that net output to the MISO grid remains the same for these periods is incorrect and conservative.

A more refined analysis would examine the unit on an hour-by-hour basis, taking into account those periods when the unit operates at full capacity, and therefore would not burn additional fuel as a result of station power for the AQCS equipment, and those periods during which the unit would operate at less than full capacity. During these periods, the unit would presumably burn more coal to power the AQCS equipment while maintaining net output to the MISO grid. Otter Tail Power Company did not perform a refined analysis, because even under the conservative assumption discussed above, the AQCS project would not result in a significant emissions increase of any regulated pollutant.

Although a reduction in mercury emissions is not part of the BART process, Otter Tail Power Company included provisions in the construction permit application in anticipation that EPA will finalize Maximum Achievable Control Technology standards for mercury control from coal-fired power plants within the construction timeline for the AQCS project. Four new storage silos will be installed at the Big Stone plant – a lime storage silo, carbon storage silo, waste FGD storage silo, and recycle storage silo or hydrated lime storage silo. The waste FGD storage silo and recycle storage silo or hydrated lime storage silo will each have two vents; however, only one vent will operate at a time. Fugitive emissions from the project will include haul road traffic, landfill pile maintenance, and landfill load-in/out.

As part of the project, the Unit #2 auxiliary boiler stack will be moved and raised. There will be no change to the auxiliary boiler or its emissions. The Unit #3 steam heating boiler is no longer in operation, and there are no plans to operate it in the future.

3.0 PROJECT EMISSIONS

3.1 Boiler (Unit #1) Emissions

The projected increase in boiler emissions as a result of the AQCS project are given in Table 2-1.

Table 2-1 – Projected Increase in Boiler (Unit #1) Emissions

Pollutant	Projected Change [1]
Carbon monoxide	7.61 tons/year
Nitrogen oxides	(11,005.3) tons/year
Sulfur dioxide	(10,949.1) tons/year
$PM/PM_{10}/PM_{2.5}$ [2] (filterable)	3.07 tons/year
$PM_{10}/PM_{2.5}$ (filterable and condensable)	(44.9) tons/year
Volatile organic compounds	2.1 tons/year
Lead	0.00044 tons/year

Fluorides	(30.24) tons/year
Sulfuric acid mist [3]	(3,970) pounds/year
Carbon dioxide equivalents	54,006 tons/year

[1] – Numbers in parentheses represent a reduction in air emissions;

[2] – PM/PM10/PM2.5 represents particulate matter, particulate matter less than 10 microns, and particulate matter less than 2.5 microns, respectively; and

[3] – Based on 2009 sulfuric acid mist emissions as reported in Toxic Release Inventory Report when compared to the projected emissions had the emissions control project been operating during the same time period;

3.2 Materials Handling Emissions

Particulate emissions are typically calculated based on the maximum capacity and assuming the unit operates 24 hours per day, 365 days per year (8,760 hours per year). The storage silos and lime hydrator will be equipped with fabric filters integral to the design and operation of the process. Therefore, potential controlled and uncontrolled emissions are considered the same.

The dry FGD alternative will have more emission points than the semi-dry system. Consequently, the particulate emissions due to materials handling will be slightly greater for the dry FGD system. Therefore, the projected materials handling emissions in Table 2-2 are based on the dry FGD alternative. Particulate emissions were calculated based on an emission rate of 0.01 gr/dscfm for the filters, the maximum air flow rate, and the capacity factor.

The emission rate for the baghouse is based on dry standard cubic feet per minute. Therefore, the actual flow rate must be converted to standard conditions. However, temperature varies throughout the year. According to data from South Dakota's Climate and Weather website (http://climate.sdstate.edu/climate_site/ag_data.htm), the temperature for South Shore, South Dakota, has varied from -34 to 116 degrees Fahrenheit with an annual average temperature of 43 degrees Fahrenheit for calendar years 2006 through 2010. To illustrate how temperature affects the particulate emission calculations, Tables 2-2, 2-3, and 2-4, represent the emissions for -40 degrees Fahrenheit, 40 degrees Fahrenheit, and 120 degrees Fahrenheit, respectively.

The flow rate for dry standard cubic foot is based on the standard conditions of 20 degrees Celsius (~68 degrees Fahrenheit or 528 Rankin) and 1 atmosphere (~14.7 pounds per square inch). Equation 3-1 is used to convert the actual conditions to the standard conditions.

Equation 3-1

$$Dscfm = (acfm)x\frac{(528\ Rankin)x(Local\ \text{Pr}essure\ pounds\ per\ square\ inch)}{(Local\ Temperature\ Rankin)x(14.7\ pounds\ per\ square\ inch)}x(1-WaterVapor)$$

Table 2-2 – Projected Particulate Emissions – Material Handling System (-40° degrees Fahrenheit)

Unit	Flow Rate (acfm)	Flow Rate (dscfm) [2]	Capacity Factor	Hours per year	Emission Rate (gr/dscf)	$PM_{10}/PM_{2.5}$ (lbs/hour)	$PM_{10}/PM_{2.5}$ (ton/year)

Unit	Flow Rate (acfm)	Flow Rate (dscfm) [2]	Capacity Factor	Hours per year	Emission Rate (gr/dscf)	$PM_{10}/PM_{2.5}$ (lbs/hour)	$PM_{10}/PM_{2.5}$ (ton/year)
#34	3,000	3,617	95%	8,322	0.01	0.30	1.26
#35	2,500	3,015	95%	8,322	0.01	0.25	1.05
#36 [1]	10,800	13,023	100%	8,760	0.01	1.09	4.79
#38 [1]	3,000	3,617	100%	8,760	0.01	0.30	1.33
#39	5,000	6,029	100%	8,760	0.01	0.51	2.22
#40	950	1,146	100%	8,760	0.01	0.10	0.42
						Total	**11.1**

[1] – Emissions based on only one vent operating at a time.

[2] –The local pressure used was 14.1 pounds per square inch, the local temperature was 420 degrees Rankin (-40 degrees Fahrenheit), and water vapor was considered negligible (0).

Table 2-3 – Projected Particulate Emissions – Material Handling System (40° Fahrenheit)

Unit	Flow Rate (acfm)	Flow Rate (dscfm)[2]	Capacity Factor	Hours per year	Emission Rate (gr/dscf)	$PM_{10}/PM_{2.5}$ (lbs/hour)	$PM_{10}/PM_{2.5}$ (ton/year)
#34	3,000	3,039	95%	8,322	0.01	0.26	1.06
#35	2,500	2,532	95%	8,322	0.01	0.21	0.89
#36 [1]	10,800	10,939	100%	8,760	0.01	0.92	4.02
#38 [1]	3,000	3,039	100%	8,760	0.01	0.26	1.12
#39	5,000	5,064	100%	8,760	0.01	0.43	1.86
#40	950	962	100%	8,760	0.01	0.08	0.35
						Total	**9.3**

[1] – Emissions based on only one vent operating at a time.

[2] –The local pressure used was 14.1 pounds per square inch, the local temperature was 500 degrees Rankin (40 degrees Fahrenheit), and water vapor was considered negligible (0).

Table 2-4 – Projected Particulate Emissions – Material Handling System (120° Fahrenheit)

Unit	Flow Rate (acfm)	Flow Rate (dscfm)[2]	Capacity Factor	Hours per year	Emission Rate (gr/dscf)	$PM_{10}/PM_{2.5}$ (lbs/hour)	$PM_{10}/PM_{2.5}$ (ton/year)
#34	3,000	2,620	95%	8,322	0.01	0.22	0.91
#35	2,500	2,183	95%	8,322	0.01	0.18	0.76
#36 [1]	10,800	9,430	100%	8,760	0.01	0.79	3.47
#38 [1]	3,000	2,620	100%	8,760	0.01	0.22	0.96
#39	5,000	4,366	100%	8,760	0.01	0.37	1.61
#40	950	830	100%	8,760	0.01	0.07	0.31
						Total	**8.0**

[1] – Emissions based on only one vent operating at a time.

[2] –The local pressure used was 14.1 pounds per square inch, the local temperature was 580 degrees Rankin (120 degrees Fahrenheit), and water vapor was considered negligible (0).

3.3 Fugitive Sources

Otter Tail Power Company calculated fugitive emissions from the landfill load-in/out, landfill pile maintenance, and for haul roads.

3.3.1 Landfill load-in/out

The landfill load-in/out emissions were based on equation 3-2 from EPA's AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles (11/06).

Equation 3-2

$$EF\left(\frac{pound}{ton}\right)=\frac{(k)x(0.0032)x\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}$$

Where the constants are as follows:

K = particle size multiplier	Particulate matter (PM) = 0.74
	Particulate matter less than 10 microns (PM10) = 0.35
	Particulate matter less than 2.5 microns (PM2.5) = 0.053
U = mean wind speed	11.1 miles per hour
M = material moisture	10.0 percent
EF = Calculated emission factor	PM = 0.000702 pounds per ton
	PM10 = 0.000332 pounds per ton
	PM2.5 = 0.0000502 pounds per ton

The potential emissions were calculated using equation 3-3.

Equation 3-3

$$E\left(\frac{tons}{year}\right)=\frac{\left(155{,}850\frac{tons\ Load-in/out}{year}\right)x\left(EF\ \frac{pound}{ton}\right)}{2{,}000\frac{pound}{ton}}$$

Based on the above equation, the calculated potential particulate emissions are as follows:

PM = 0.05 tons per year
PM10 = 0.03 tons per year
PM2.5 = 0.00 tons per year

3.3.2 Landfill Maintenance

The landfill maintenance emissions were based on equation 3-4 from EPA's AP-42 Chapter 13.2.2 Unpaved Roads (11/06).

Equation 3-4

$$EF\left(\frac{pound}{mile}\right) = (k)x\left(\frac{S}{12}\right)^{a} x\left(\frac{W}{3}\right)^{b}$$

Where the constants are as follows:

k = particle size multiplier	Particulate matter (PM) = 4.9
	Particulate matter less than 10 microns (PM10) = 1.5
	Particulate matter less than 2.5 microns (PM2.5) = 0.15
S = silt content	2.2 percent
W = vehicle weight	33 tons
a = AP-42 constant	PM = 0.7
	PM10 = 0.9
	PM2.5 = 0.9
b = AP-42 constant	PM = 0.45
	PM10 = 0.45
	PM2.5 = 0.45
EF = Calculated emission factor	PM = 4.40 pounds per miles traveled
	PM10 = 0.96 pounds per miles traveled
	PM2.5 = 0.10 pounds per miles traveled

The potential emissions were calculated using equation 3-5.

Equation 3-5

$$E\left(\frac{tons}{year}\right) = \frac{\left(788.4\frac{miles}{year}\right)x\left(EF\ \frac{pound}{mile}\right)}{\left(2{,}000\frac{pound}{ton}\right)}$$

Based on the above equation, the potential particulate emissions are as follows:

PM = 1.73 tons per year
PM10 = 0.38 tons per year
PM2.5 = 0.04 tons per year

3.3.3 Haul Roads

The haul road emissions were based on equation 3-6 from EPA's AP-42 Chapter 13.2.1 Paved Roads (01/11).

Equation 3-6

$$EF\left(\frac{pound}{mile}\right) = (k)x(S)^{0.91}x(W)^{1.02}$$

Where the constants are as follows:

k = particle size multiplier	Particulate matter (PM) = 0.011
	Particulate matter less than 10 microns (PM10) = 0.0022
	Particulate matter less than 2.5 microns (PM2.5) = 0.00054
S = silt content	0.6 percent
W = vehicle weight	44.4 tons
EF = Calculated emission factor	PM = 0.331 pounds per miles traveled
	PM10 = 0.066 pounds per miles traveled
	PM2.5 = 0.016 pounds per miles traveled

The potential emissions were calculated using equation 3-7.

Equation 3-7

$$E\left(\frac{tons}{year}\right) = \frac{\left(17{,}482.2\frac{miles}{year}\right)x\left(EF\frac{pound}{mile}\right)}{\left(2{,}000\frac{pound}{ton}\right)}$$

Based on the above equation, the calculated potential particulate emissions are as follows:

PM = 2.89 tons per year
PM10 = 0.58 tons per year
PM2.5 = 0.14 tons per year

4.0 PERMIT REQUIREMENTS

4.1 New Source Review

ARSD 74:36:10:01 states that New Source Review (NSR) regulations apply to areas of the state which are designated as nonattainment pursuant to the Clean Air Act for any pollutant regulated under the Clean Air Act. Big Stone power plant is located near Big Stone City, South Dakota, which is in attainment or unclassifiable for all the pollutants regulated under the Clean Air Act. Therefore, the proposed AQCS project is not subject to NSR review.

4.2 Prevention of Significant Deterioration

The original Prevention of Significant Deterioration (PSD) rules in effect prior to March 1, 1978, were published in the Federal Register on December 5, 1974. These rules applied to the following 17 specific source categories and which were constructed after June 1, 1975:

1. Fossil-Fuel Steam Electric Plants of more than 1,000 million Btus;

2. Kraft Pulp Mills;
3. Portland Cement Plants;
4. Primary Zinc Smelters;
5. Iron and Steel Mills;
6. Primary Aluminum Ore Reduction Plants;
7. Primary Copper Smelters;
8. Municipal Incinerators capable of charging more than 250 tons of refuse per 24 hour day;
9. Sulfuric Acid Plants;
10. Petroleum Refineries;
11. Lime Plants;
12. Phosphate Rock Processing Plants;
13. By-Products Coke Oven Batteries;
14. Sulfur Recovery Plants;
15. Carbon Black Plants;
16. Primary Lead Smelters; and
17. Fuel Conversion Plants.

Big Stone power plant is considered a fossil-fuel electric plant of more than 1,000 million Btus, which is one of the 17 named PSD source categories. However, Big Stone commenced construction prior to June 1, 1975, and was not required to obtain a PSD permit under the original PSD rules.

Under the current PSD rules, a PSD review applies to new major stationary sources and major modifications to existing major stationary sources in areas designated as attainment under Section 107 of the Clean Air Act for any regulated pollutant. The following is a list of regulated pollutants under the PSD program:

1. Total suspended particulate matter (TSP);
2. Particulate matter 10 microns in diameter or less (PM10);
3. Particulate matter 2.5 microns in diameter or less (PM2.5);
4. Sulfur dioxide (SO_2);
5. Nitrogen oxides (NOx);
6. Carbon monoxide (CO);
7. Ozone – measured as volatile organic compounds (VOCs);
8. Lead;
9. Greenhouse gases (carbon dioxide, nitrous oxide, methane, etc.)
10. Fluorides;
11. Sulfuric acid mist;
12. Hydrogen sulfide;
13. Reduced sulfur compounds; and
14. Total reduced sulfur.

If the source is considered one of the 28 named PSD source categories listed in Section 169 of the federal Clean Air Act, the major source threshold is 100 tons per year of any regulated pollutant, except for greenhouse gases. The major source threshold for all other sources is 250

tons per year of any regulated pollutant, except for greenhouse gases.

The major source threshold for greenhouse gases is given below:

1. New PSD source because of a criteria air pollutant, the major source threshold for greenhouse gases is 75,000 tons per year of carbon dioxide equivalent or more;
2. New PSD source if greenhouse gas emissions are 100,000 tons per year of carbon dioxide equivalent or more;
3. For an existing PSD source because of a criteria air pollutant, a major modification for greenhouse gases is an increase of 75,000 tons per year of carbon dioxide equivalent or more;
4. For an existing non-PSD source that has the potential to emit 100,000 tons per year of carbon dioxide equivalent emissions or more, a major modification for greenhouse gases is an increase of 75,000 tons per year of carbon dioxide equivalent or more; and
5. In addition to subsection (2) and (4), a specific greenhouse gas, without calculating the carbon dioxide equivalent, also needs to emit greater than 100 or 250 tons per year, whichever is applicable, to be regulated.

Big Stone is considered a fossil fueled boiler with a heat input greater than 250 million Btus per hour, which is one of the 28 named PSD source categories. Although Big Stone has the potential to emit greater than the major source threshold under the PSD program, construction of the Big Stone power plant commenced prior to August 7, 1977. Therefore, Big Stone was not required to obtain a PSD permit under the current PSD rules.

The Big Stone power plant is considered a major source; therefore, any changes to the existing facility require evaluation to determine whether the proposed change is considered a major modification under the PSD program. A major modification under PSD is defined as any physical change or change in the method of operation of a major source resulting in a significant emissions increase of a regulated pollutant and a significant net emissions increase of that pollutant. A significant emissions increase under PSD is defined as a net emissions increase or the potential emissions increase that equals or exceeds the pollutant specific thresholds in 40 Code of Federal Regulation (CFR) § 52.21(b)(23)(i) and/or, major modifications constructed within 10 kilometers of a Class I area, that impact a Class I area equal to or greater than 1 microgram per cubic meter ($\mu g/m^3$) (24-hour average). The Big Stone power plant is not located within 10 kilometers of a Class I area.

The PSD regulations establish the following procedure for determining if a proposed project is subject to a PSD review:

1. Determine the potential increase in emissions from the proposed project and compare it to the significant emission rates in 40 CFR §52.21(b)(23). If the potential increase (does not include or consider any proposed decreases resulting from the proposed project) is greater than the significant emission rate, proceed; if not, the source is not subject to a PSD review.

2. Determine the beginning and ending dates of the contemporaneous period as it relates to the proposed modification.
3. Determine which emissions units at the source experienced (or will experience, including any proposed decreases resulting from the proposed project) a creditable increase or decrease in emissions during the contemporaneous period.
4. Determine which emissions changes are creditable.
5. Determine, on a pollutant-by-pollutant basis, the amount of each contemporaneous and creditable emissions increase and decrease.
6. Sum all contemporaneous and creditable increases and decreases with the increase from the proposed modification to determine if a significant net emissions increase will occur.

Table 4-1 provides a comparison of the potential emissions increase for this project, as noted in step 1 above, to the significant threshold in the PSD program under 40 CFR § 52.21(b)(23). For emission units that show a decrease in emissions, the increase of emissions in the table is identified as zero. The decrease in emissions would be considered during steps 2 through 6, if necessary.

Table 4-1 – Comparison of Potential Emissions Increase to Significant Thresholds

	Source	**Potential Emissions Increase Tons/year**		**Significant Threshold Tons/year**	**PSD Applicable**
Particulate Matter (filterable)	Materials Handling	9.3	17	25	No
	Landfill Loading	0.05			
	Landfill Pile	1.73			
	Haul Roads	2.89			
	Boiler	3.07			
PM10 (filterable and condensable)	Materials Handling	9.3	10	15	No
	Landfill Loading	0.03			
	Landfill Pile	0.37			
	Haul Roads	0.58			
	Boiler	0.00			
PM2.5 (filterable and condensable)	Materials Handling	9.3	9	10	No
	Landfill Loading	0.00			
	Landfill Pile	0.04			
	Haul Roads	0.14			
	Boiler	0.00			
Sulfur Dioxide	Boiler	0	0	40	No
Nitrogen Oxide	Boiler	0	0	40	No
Carbon Monoxide	Boiler	7.6	8	100	No
Volatile Organic Compounds	Boiler	2.1	2	40	No
Lead	Boiler	0.00	0	0.6	No

	Source	Potential Emissions Increase Tons/year		Significant Threshold Tons/year	PSD Applicable
Greenhouse Gases	Boiler	54,006	54,006	75,000	No
Fluorides	Boiler	0	0	3	No
Sulfuric Acid Mist	Boiler	0	0	7	No
Hydrogen Sulfide	Boiler	0	0	10	No
Reduced Sulfur Compounds	Boiler	0	0	10	No

Based on Table 4-1, the proposed AQCS project is not considered a major modification under the PSD program and therefore is not subject to a PSD review. Therefore, steps 2 through 6 of the applicability analysis given above are not required.

4.3 New Source Performance Standards

The department reviewed the New Source Performance Standards (NSPS) in 40 CFR Part 60 and determined that the following may be applicable.

4.3.1 ARSD 74:36:07:02 – 40 CFR, Part 60, Subpart D – Standards of Performance for Fossil-Fuel-Fired Steam Generators for Which Construction is Commenced After August 17, 1971

The provisions of this subpart are applicable to the following:

1. Each fossil-fuel-fired steam generating unit of more than 73 megawatts (MW) heat input rate (250 million Btus per hour);
2. Each fossil-fuel and wood-residue-fired steam generating unit capable of firing fossil fuel at a heat input rate of more than 73 MW (250 MMBtus/hr); and
3. Commenced construction or modification after August 17, 1971.

Unit #1 is currently permitted under the Title V air quality operating permit for the Big Stone power plant. Unit #1 is a fossil-fuel-fired steam generating unit with a maximum design heat input capacity greater than 250 MMBtus per hour. Otter Tail Power Company commenced construction on Unit #1 on January 18, 1971, as stated in a letter from the EPA to Otter Tail Power Company on September 5, 1972. Therefore, Unit #1 initially was not subject to this new source performance standard. The proposed AQCS project will include several changes to Unit #1. A unit modified after August 17, 1971, is subject to the provisions of this subpart. In accordance with 40 CFR §60.40(e), any facility covered under 40 CFR, Part 60, Subpart Da, is not covered under this subpart. Therefore, Unit #1 will be evaluated for coverage under subpart Da.

The maximum design heat input capacity for Unit #2 and #3 is less than 250 MMBtus/hr. Therefore, Unit #2 and #3 are not subject to this subpart. The maximum design heat input capacity of Unit #13 is greater than 250 MMBtus/hr. However, Unit #13 was part of the proposed Big Stone II project, which Otter Tail and its partners have decided not to construct.

4.3.2 ARSD 74:36:07:03 – 40 CFR, Part 60, Subpart Da – Standards of Performance for Electric Utility Steam Generating Units for Which Construction is Commenced After September 18, 1978

The provisions of this subpart are applicable to each electric utility steam generating unit:

1. That is capable of combusting more than 73 megawatts (MW) (250 million Btus per hour) heat input of fossil fuel (either alone or in combination with any other fuel); and
2. For which construction, modification, or reconstruction is commenced after September 18, 1978.

Unit #1 is an electric utility steam generating unit with a heat input of 5,609 million Btus per hour. The unit is fired with subbituminous coal and other alternative fuels and wastes. Several changes will be made to Unit #1 as part of the AQCS project. Therefore, Unit #1 may now be subject to this subpart.

Construction refers to the construction of a "new" affected facility. Unit #1 was constructed prior to September 1978. Therefore, Otter Tail Power Company is not applicable due to "construction" of an electric utility steam generating system.

Reconstruction refers to the fixed capital cost of the new components compared to the fixed capital cost of a new comparable facility. If the cost of the new components exceeds 50% of the cost for a new facility, reconstruction of the facility has occurred. Otter Tail Power Company estimated the fixed capital cost associated with changes solely to the boiler (i.e. no cost of controls, etc.) to be approximately $80 million dollars and the fixed capital cost associated with a comparable new boiler (i.e no cost of controls, auxiliary equipment, etc.) in excess of $300 million dollars. The new components constitute less than 27% of the cost of a new boiler. Therefore, the Big Stone power plant is not subject to the "reconstruction" provisions of this subpart.

Modification refers to an increase in the hourly emission rate for the pollutants regulated by the standard. Subpart Da regulates emissions of particulate matter (filterable), sulfur dioxide, and nitrogen oxide. The subpart also lists a standard for mercury. However, the Clean Air Mercury Rule was vacated by the D.C. Circuit Court on February 8, 2008. Therefore, mercury is not covered by this subpart.

To determine the pre-project maximum hourly emission rates, particulate matter performance tests and the continuous emission data from the acid rain program were reviewed. Those hourly emission rates were compared to the hourly emission limits required by the Best Available Retrofit Technology requirements under the Regional Haze program. The proposed project is being implemented due to requirements of the Regional Haze program. A summary of the comparison may be seen in Table 4-2.

Table 4-2 – Hourly Emission Rate Comparison

Pollutant	Actual Operational Data		Regional Haze Program Requirement
Particulate Matter (filterable)	June 2, 1997, test	68.2 pounds per hour 3-hour average	67.3 pounds per hour 3-hour average
	April 29, 1999, test	78.6 pounds per hour 3-hour average	
	April 21, 2011, test	89.9 pounds per hour 3-hour average	
Sulfur Dioxide	2006 calendar year Acid Rain Program	6,369.8 pounds per hour Maximum hourly rate	505 pounds per hour 30-day rolling average
	2007 calendar year Acid Rain Program	3,757.1 pounds per hour Maximum hourly rate	
	2008 calendar year Acid Rain Program	4,516.3 pounds per hour Maximum hourly rate	
Nitrogen Oxide	2006 calendar year Acid Rain Program	5,089.4 pounds per hour Maximum hourly rate	561 pounds per hour 30-day rolling average
	2007 calendar year Acid Rain Program	4,184.3 pounds per hour Maximum hourly rate	
	2008 calendar year Acid Rain Program	7,078.2 pounds per hour Maximum hourly rate	

Changes to Unit #1 are contingent on final project design and review by the Big Stone plant co-owners. In the permit application, Otter Tail Power Company stated the boiler efficiency is expected to improve as a result of the boiler work, but the hourly boiler heat input will not increase above the currently permitted level of 5,609 MMBtus per hour. As such, there should be no increase in hourly emissions of any regulated air pollutant. As noted in Table 4-2, Otter Tail Power Company's hourly emission rates for those pollutants that the standard applies to will not increase. Therefore, the Big Stone power plant is not subject to the "modification" provisions of this subpart.

Since Otter Tail is not constructing, modifying, or reconstructing an electric utility steam generating system, the Big Stone power plant is not subject to this subpart.

4.3.3 40 CFR, Part 60, Subpart HHHH – Emission Guidelines and Compliance Times for Coal-Fired Electric Steam Generating Units

EPA issued the Clean Air Mercury Rule (CAMR) on March 15, 2005, to significantly reduce mercury emissions from coal-fired power plants and creating a market-based cap-and-trade program. The provisions of this subpart were applicable to any stationary, coal-fired boiler or stationary, coal-fired combustion turbine serving at any time, since the later of November 15, 1990, or the start-up of the unit's combustion chamber, a generator with nameplate capacity of

more than 25 MW producing electricity for sale. Unit #1 is a coal-fired electric steam generating unit with a nameplate capacity greater than 25 megawatts. The Clean Air Mercury Rule was vacated by the D.C. Circuit Court on February 8, 2008. Therefore, this subpart is no longer applicable.

4.4 National Emission Standards for Hazardous Air Pollutants (Part 61)

The department reviewed the National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR Part 61 and determined there are no NESHAP standards applicable to Big Stone's AQCS project.

4.5 Maximum Achievable Control Technology Standards (Part 63)

DENR reviewed the Maximum Achievable Control Technology (MACT) standards and determined that there are no promulgated maximum achievable control technology standards applicable to the AQCS project.

4.5.1 40 CFR, Part 63, Subpart UUUUU – Utility NESHAP

On May 3, 2011, EPA proposed the Mercury and Air Toxics Standards (MATS). EPA is proposing to reduce emissions of toxic air pollutants from coal- and oil-fired electric utility steam generating units (EGUs). EPA is also proposing to revise the new source performance standards for fossil-fuel-fired EGUs.

The proposed standards are National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units. On June 21, 2011, EPA extended the timeline for public comment on the proposed mercury and air toxics standards for power plants by 30 days to August 4, 2011. The extension applied to both the NESHAP and NSPS portions of the Mercury and Air Toxics Standards.

Mercury control is not addressed as part of the BART process. However, Otter Tail Power Company is planning to install an activated carbon injection system as part of the AQCS project in anticipation that EPA will finalize Maximum Achievable Control Technology standards for mercury emissions from coal-fired power plants within the construction timeline for the AQCS project.

4.6 Acid Rain Program

Unit #1 is subject to the Acid Rain Program. The Acid Rain Program requirements have been incorporated in Big Stone's Title V air quality operating permit.

4.7 Best Available Retrofit Technology (BART) Determination

Best available retrofit technology is an emission limitation based on the degree of reduction achievable through the application of the best system of continuous emission reduction for each pollutant that is emitted by an existing stationary facility. The emission limitation must be established, on a case-by-case basis, taking into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility that may reasonably be anticipated to result from the use of such technology.

The Big Stone Power plant is a BART-eligible coal-fired power plant under South Dakota's Regional Haze Program in ARSD 74:36:21. In accordance with ARSD 74:36:21:06, the owner or operator of a BART-eligible coal-fired power plant may not cause or permit emissions of the following regulated air pollutant in excess of the following amounts:

1. PM_{10} emissions in excess of 67.3 pounds per hour, which includes periods of startup and shutdown;
2. PM_{10} emissions in excess of 0.012 pounds per million Btus, which includes periods of startup and shutdown;
3. Sulfur dioxide emissions in excess of 505 pounds per hour, which includes periods of startup, shutdown, and malfunction;
4. Sulfur dioxide emission in excess of 0.09 pounds per million Btus, which includes periods of startup, shutdown, and malfunction;
5. Nitrogen oxide emission in excess of 561 pounds per hour, which includes periods of startup, shutdown, and malfunction; and
6. Nitrogen oxide emissions in excess of 0.10 pounds per million Btus, which includes periods of startup, shutdown, and malfunction.

Otter Tail Power Company plans to retrofit Unit #1 with a selective catalytic reduction system and separated over-fire-air for nitrogen oxide control and a semi-dry or dry flue gas desulfurization system for sulfur dioxide control to comply with the requirements of the BART determination. The existing fabric filter for particulate matter control will be replaced with a new fabric filter.

4.8 State Emission Limits

The State of South Dakota has established total suspended particulate matter and sulfur dioxide emission limits in ARSD 74:36:06 and a standard for opacity in ARSD 74:36:12. In accordance with ARSD 74:36:12:01, each unit is subject to a visible emission limit of less than 20 percent opacity.

Unit #1 will be required to comply with the particulate and sulfur dioxide emission limits in ARSD 74:36:21:06 under the state's regional haze program. These emission limits are more stringent than the state's emission limits for fuel-burning units in 74:36:06:02.

Particulate emission limits for the baghouses on the silos will be based on the manufacturer's controlled emission rates given in the Otter Tail's permit application. Particulate emission limits of 0.01 grains per dry standard cubic foot will be placed in the permit, which is more stringent than the state's particulate emissions limit in ARSD 74:36:06:03.

4.9 Air Quality Construction Permit

In accordance with ARSD 74:36:20:01, Otter Tail Power Company is required to submit an application for a construction permit since the proposed AQCS project is considered a modification under its Title V air quality operating permit. Otter Tail Power Company will be required to submit an application for a modification to the Title V air quality operating permit within 12 months of startup of the AQCS project.

4.10 Summary of Applicable Requirements

Otter Tail Power Company will be required to comply with the requirements stipulated in the following regulations:

- ARSD 74:36:05 – Operating Permits for Part 70 Sources;
- ARSD 74:36:06 – Regulated Air Pollutant Emissions;
- ARSD 74:36:07 – New Source Performance Standards;
- ARSD 74:36:11 – Performance Testing;
- ARSD 74:36:12 – Control of Visible Emissions;
- ARSD 74:36:13 – Continuous Emission Monitoring Systems;
- ARSD 74:36:16 – Acid Rain Program;
- ARSD 74:36:20 – Construction Permits for New Sources or Modifications; and
- ARSD 74:36:21 – Regional Haze Program.

5.0 RECOMMENDATION

Based on the information submitted in the air quality permit application, the department recommends conditional approval of an air quality construction permit for Otter Tail Power Company for the Big Stone Power Plant near Big Stone City, South Dakota. Questions regarding this permit review should be directed to Marlys Heidt, Engineer III.